Assessing Endpoints and Setting Nutrient Limits in Permits

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Regulatory Background

- NPDES permits must include effluent limits for all pollutants discharged at levels which have the reasonable potential to cause or contribute to an excursion above any State water quality Standard, including narrative water quality criteria
- Limits based on narrative criteria must be established using:
  - A calculated criterion which the permitting authority demonstrates will attain and maintain narrative water quality criteria, or
  - EPA's Clean Water Act Section 304(a) water quality criteria, or
  - An indicator parameter for the pollutant of concern.

(40 CFR 122.44(d)(1))

Endpoints: Effects of Excess Nutrients

- Nuisance algae
  - Attached algae (periphyton) on substrate in rivers.
  - Algae blooms in lakes and reservoirs.
- Nuisance macrophytes.
- Low dissolved oxygen
  - Diurnal violations of DO criteria in rivers and streams.
  - Sustained violations in stratified lakes, reservoirs, and estuaries.
- pH
  - Diurnal violations (both high and low) in rivers.

Periphyton: Yakima River near Zillah, WA

Blue-green algae bloom: Lake Spokane, Washington

Macrophyte Growth: Yakima River near Kiona, Washington

Difficulties in Setting Permit Limits

- Region 10 states generally have narrative criteria for nuisance algae.
  - Subject to interpretation.
- Dissolved oxygen and pH have numeric criteria, but the relationship between nutrients on these endpoints is site-specific and difficult to predict.
  - Modeling is usually necessary.
  - "All models are wrong, but some are useful." — *George Edward Pehlam Box*
    - How "wrong" can a model be and still be "useful?"
- Existing permitting guidance is geared toward toxic pollutants.
  - Toxics act relatively quickly, and near the point of discharge.
  - Nutrients act relatively slowly, and possibly at great distances from the point of discharge.
- Protective limits are often stringent.
  - Push-back from regulated community.
- TMDL-based limits are not necessarily easy either.
- Are seasonal limits acceptable?
- Is it acceptable to control only the limiting nutrient?

How Region 10 is Meeting the Challenge of Nutrient Limits

- Bases for nutrient limits:
  - Interpreting narrative criteria for excess nutrients.
    - Calculated criterion
      - In-stream targets from TMDLs
      - Reference reaches
    - 304(a) Criteria
      - Quality Criteria for Water 1986 ("Gold Book")
        - Phosphorus only
      - Ecoregional Nutrient Criteria (2000)
  - Limits to protect DO or pH criteria based on modeling.
  - Implementing TMDLs.

Examples: Interpreting Narrative Criteria for Excess Nutrients

- Calculated Criteria
  - In-stream targets from TMDLs
    - Lower Boise watershed permits applied the 70 µg/L total phosphorus (TP) target from the downstream Snake River Hells Canyon TMDL
  - Reference Reaches
    - Same methodology as the Ecoregional Nutrient Criteria.
    - Upper percentile of unimpacted sites or lower percentile of impacted sites.
- 304(a) Criteria
  - Gold Book
    - City of Plummer, ID
    - City of Toppenish, WA
    - Short averaging period (WLA = average monthly limit)
  - Ecoregional Nutrient Criteria
    - City of Sandpoint (preliminary draft)
    - Annual or seasonal averaging period

Example: Modeling to Protect DO Criteria

- Spokane River Wastewater Treatment Plants (Coeur d'Alene, Post Falls and Hayden)
  - Limits for phosphorus, carbonaceous biochemical oxygen demand, and ammonia based on Washington's water quality criterion for DO in Lake Spokane.
  - Difficulties:
    - Stringent standard.
      - Strives for nearly "natural" conditions in a man-made lake downstream from a densely-populated watershed.
      - Requires TP limits at the limit of technology, reductions in non-point source and stormwater pollution, and changes in dam operation.
    - Multiple jurisdictions.
      - Initial draft permits didn't apply the standard cumulatively to all sources in both states.
      - Every pound of pollution allocated to Washington sources is one less pound that can be allocated to Idaho, and vice versa.
    - Complicated model: Lots of time spent getting buy-in on the model.

Unresolved Issues

- Limiting Nutrient
  - EPA's general recommendation is to control both nitrogen and phosphorus.
    - Makes sense in watersheds with significant point source loads that are upstream of impaired estuaries (e.g. Mississippi River → Gulf of Mexico, Chesapeake Bay).
    - May not make sense for the upper Columbia River basin.
    - Point source control of both N and P is expensive.
  - So far, EPA Region 10's NPDES permits have almost exclusively limited phosphorus.
    - Limits on ammonia and nitrates for toxicity, not eutrophication.
- Seasonal Limits
  - Some nutrient TMDLs only apply during the "growing season" (e.g. May – September).
  - Impairments can occur outside the growing season.
  - In lakes, reservoirs, and estuaries, nutrients retained in sediment can have an impact long after being discharged.
- TMDL Ambiguity
  - Is it a maximum or an average? If it's an average, over what length of time?
  - Homedale NPDES permit appealed because the WLA was implemented as an average monthly limit. Petitioner argues it should have been maximum daily.

Questions